

Compiling Global Wind Field from the NASA Scatterometer and Studying Its Relation with Anomalous Warming in the Pacific

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At the end of May 1997, three regions of anomalous warming in the North Pacific were observed. Positive sea surface temperature (SST) anomalies were found along the entire central and eastern equatorial Pacific, as part of a brewing El Nino. At the same time, SST anomalies were observed off the coast of Mexico and along the coast of the United States from northern California to Washington. It is speculated these three simultaneous anomalous warming are related to anomalous wind pattern.

To understand the ocean surface wind pattern, a successive correction method was employed to objectively interpolated the ocean surface wind from the NASA Scatterometer (NSCAT). The interpolation alleviates errors caused by the uneven satellite sampling while retaining the superior energy-content of the wind field. It is demonstrated that the interpolated wind field have more structures than those provided by operational numerical weather forecast, particularly in the equatorial Pacific where sharp changes in direction occur.

NSCAT data reveal strong westerly wind anomalies in the equatorial central Pacific which generate ocean Kelvin waves and may suppress equatorial upwelling. These west wind anomalies appear to branch north, spearhead towards the northeast, passing Hawaii, aiming at San Francisco. This anomalous surface flow is part of the anomalous cyclonic flow around an anomalous low pressure system in the North Pacific. Along the coast of Mexico, the northerly wind anomalies which is part of the cyclonic flow suppress the normal coastal upwelling of cold water. In the extratropical open ocean, the variation of surface temperature is largely governed by surface heat flux. Winds coming from the tropical ocean bring heat, moisture, and surface convergence; they suppress evaporative cooling. The opposite is true for winds from the north. The position of a persistent dipole of SST anomalies are found to correlated with the meridional wind anomalies. In May, the intensification of the cyclonic flow at mid-latitude pushed the warm part of the dipole towards the coast.